Chapter 5

Conclusion

5.1 Introduction

Mixtures of distributions have received an interesting amount of interest, both for theoretical reason and out of practical considerations. The ensuing century has revealed a multitude of fields of application which exemplify features that demand the use of mixture models.

The remarkable fact about mixture distributions is that there are lots of real life situations where the concept of mixture distributions can be applied. For example, in life testing experiments, the systems will be failed due to different causes and the times to failure due to different reasons are likely to follow different distributions. Knowledge of these distributions is essential to eliminate cause of failures and thereby to improve the reliability.

In chapter 2, we have examined the role of finite mixture of exponential distribution in the context of renewal and reliability theory. In chapter 3, we discussed various ageing characteristics of the finite mixture of geometric distributions.

Finite mixture of exponential and finite mixture of geometric distributions qualify themselves as satisfactory models in situations where hazard rate functions is showing decreasing pattern. However these two mixtures show an increasing failure rate property depending upon the values of the mixing weights. Since decreasing hazard rate is most commonly encountered in many real life situations, finite mixture of exponential and finite mixture of geometric distributions can be ideal choice for modelling a wide range of such situations when parametric methods are resorted to.

Various reliability sampling plans have been developed in the literature. When the lifetime of a product follows a generalized exponential distribution, proper sampling plans are to be developed in chapter 4. The sampling plan developed based on generalized
exponential distribution was proved to be successful not only in providing a feasible plan but also in determining the minimum ratio of the true mean life to a specified mean life for a given producer’s risk. This ratio is helpful in finding the level up to which the quality improvement is needed. The continuous improvement and review of reliability sampling plan is important to enhance the quality of the products and to ensure customer satisfaction.

5.2 Extensions and Further Research

Various results and applications in different contexts discussed in this thesis were challenging and inspiring and there are ample opportunities for further research. Renewal function and renewal density are two intrinsic concepts in renewal theory. The renewal function and renewal densities are basic tools also used in probabilistic models arising in other areas such as reliability theory, inventory theory, and continuous sampling plans. Estimation of renewal function and renewal density in mixture models are some open problems which can be pursued in future.

There is enormous literature on reliability modelling, inference relating to reliability characteristics and various notions of ageing and applications to specific problem in continuous time. However, there has been relatively less work on reliability when lifetime is treated as discrete. Reliability theory, therefore, needs to be developed for discrete descriptions of life maintaining similarity with the continuous counterpart.

In industrial settings, the production of products is done in one or more streams and the lots are made combining the products from all streams. There may be inherent variation in the quality of products belonging to different streams. For example, there are often two groups: defective components with shorter lifetimes and standard components with longer lifetimes. Another heterogeneous population results when components produced by two different manufacturing lines are combined. In either case a mixture results. Under these circumstances, a finite mixture distribution is an appropriate probability model to the number of defective items in the sample selected from such heterogeneous lot. The research in this direction will be reported elsewhere.